RATION TREATY (PCT)

(19) World Intellectual Property Organization International Bureau



(43) International Publication Date 26 February 2004 (26.02.2004)

PCT

(10) International Publication Number WO 2004/016172 A1

(51) International Patent Classification7: 5/02, 5/0456

A61B 5/16,

(21) International Application Number:

PCT/FI2003/000608

(22) International Filing Date: 18 August 2003 (18.08.2003)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data: 20025039

16 August 2002 (16.08.2002)

- (71) Applicant (for all designated States except US): FIRST-BEAT TECHNOLOGIES OY [FI/FI]; Rautpohjankatu 6, FIN-40700 Jyväskylä (FI).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): KETTUNEN, Joni [FI/FI]; Haikantie 3, FIN-40900 Säynätsalo (FI). SAALASTI, Sami [FI/FI]; Majajärventie 3 as FIN-40600 Jyväskylä (FI).
- (74) Agent: KESPAT OY; P.O. Box 601, FIN-40101 Jyväskylä

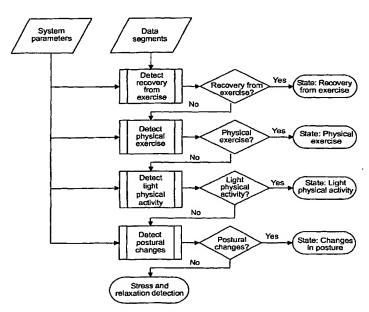
- (81) Designated States (national): AE, AG, AL, AM, AT (utility model), AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), CZ, DE (utility model), DE, DK (utility model), DK, DM, DZ, EC, EE (utility model), EE, ES, FI (utility model), FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK (utility model), SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
- (84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: PROCEDURE FOR DETECTION OF STRESS BY SEGMENTATION AND ANALYSING A HEART BEAT SIGNAL



(57) Abstract: The invention relates a procedure for the detection of stress state, wherein ambulatory heart beat signal is measured. In the first phase segments are defined from heart beat signal with a chosen rule for segmentation. Then at least one segment describing a physiological state with elevated cardiac activity due to physical workload and/or increased metabolic rate is identified and excluded, if exists, and segments other than the excluded segments are detected for a potential stress state, which is identified using a predetermined rule for the heart beat signal.



INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61B 5/16, A61B 5/02, A61B 5/0456
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A61B, A63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, INSPEC, MEDLINE, BIOSIS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5267568 A (ATSUNORI TAKARA), 7 December 1993 (07.12.93), figure 1, abstract	1-14
		
A	US 5891044 A (BORIS GOLOSARSKY ET AL), 6 April 1999 (06.04.99), figure 5, abstract	1-14
		
Α .	US 6104947 A (ILKKA HEIKKILÄ ET AL), 15 August 2000 (15.08.00), figure 5, abstract	1-14
		

X	Further documents are listed in the continuation of Box	C.	X See patent family annex.		
* "A"	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand		
	document defining the general state of the art which is not considered to be of particular relevance		the principle or theory underlying the invention		
"E"	earlier application or patent but published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive		
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other		step when the document is taken alone		
	special reason (as specified)	"Y"	document of particular relevance: the claimed invention cannot be		
"O"	document referring to an oral disclosure, use, exhibition or other means		considered to involve an inventive step when the document is combined with one or more other such documents, such combination		
"P"	document published prior to the international filing date but later than		being obvious to a person skilled in the art		
	the priority date claimed	"&"	document member of the same patent family		
Dat	Date of the actual completion of the international search		Date of mailing of the international search report		
			(0 . 5 - 11- 2003		
4	November 2003				
Name and mailing address of the ISA/		Authorized officer			
Swe	edish Patent Office				
	k 5055, S-102 42 STOCKHOLM	Patr	rik Widerdal/mj		
Fac	simile No. +46 8 666 02 86	Telepl	none No. +46 8 782 25 00		

INTERNATIONAL SEARCH REPORT

Internatial application No. PCT, 203/00608

		PC1/FE 03/00608			
C (Continu	ation). DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the rele	vant passages	Relevant to claim No		
A	US 5419338 A (JONNALAGEDDA S.M. SARMA ET AL), 30 May 1995 (30.05.95), figure 3, abstract		1-14		
A	US 5902250 A (RICHARD L. VERRIER ET AL), 11 M 1999 (11.05.99), figure 1, abstract	ay	1-14		
P,A	US 6358201 B1 (DOC L. CHILDRE ET AL), 19 March 2002 (19.03.02), figure 1, abstract		1-14		
A	Fukushima S. et al "A VR relax/refresh system employing physiological feedback". Trans. Inst. Electr. Eng. Jpn. C (Japan), Transactions of the Institute of Electric Engineers of Japan, Part C, Feb.1995, Jap Page(s) 222-229, INSPEC AN: 4922327 Retrieved on 31 October 2003	al	1-14		
	·		•		
	SA/210 (continuation of second sheet) (July 1998)				

INTERNATIONAL SEARCH REPORT Information on partial family members

06/09/03

Interpolal application No.
PCT 1 03/00608

	nt document 1 search report		Publication date		Patent family member(s)	Publication date
US	5267568	A	07/12/93	AU	640044 B	12/08/93
	020,000	•	· · / LL/ 50	ÜA	8450591 A	21/05/92
				BE	1004497 A	01/12/92
				CH	685917 A	15/11/95
				DE	4133608 A	21/05/92
				FR	2669450 A,B	22/05/92
					2251490 A,B	08/07/92
				GB		
				GB	9117433 D	00/00/00
				ΙŢ	1258223 B	21/02/96
				IT	MI912536 D	00/00/00
				JP	1847061 C	07/06/94
				JP	4180730 A	26/06/92
				JP	5058730 B	27/08/93
				KR	138506 B	27/04/98
_				SE	9103165 A	17/05/92
 US	5891044	Α	06/04/99	AU	3070495 A	16/02/96
				CA	2195018 A	01/02/96
				EP	0771170 A	07/05/97
				JP	10505515 T	02/06/98
				ÜS	5718235 A	17/02/98
				WO	9602185 A	01/02/96
- US	6104947	Α	15/08/00	EP	0748185 A	18/12/96
	0201317	• •	20, 00, 00	ĒP	0804120 A	05/11/97
				FΙ	100452 B	0.0/00/00
				FĪ	110303 B	00/00/00
				FĪ	946164 A	09/08/96
				FΪ	952656 A	09/08/96
				ĴР	9509877 T	07/10/97
	•			US	5840039 A	24/11/98
				MO	9620640 A	11/07/96
				WO	9620641 A	11/07/96
					. 9020041 A	11/0//90
US 	5419338	A	30/05/95	NONE		
us Us	5902250	Α	11/05/99	DE	19882266 T	07/09/00
				GB	2339476 A,B	26/01/00
				GB	9923158 D	00/00/00
				JP	2001522266 T	13/11/01
				WO	9843536 A	08/10/98
us	6358201	B1	19/03/02	AU	3507200 A	21/09/00
			,,	CA	2364032 A	08/09/00
				CN	1358074 T	10/07/02
				EP	1156851 A	28/11/01
				JP	2002537911 A	12/11/02
				WO	0051677 A	08/09/00
				MO	0031011 K	00/03/00